



HEALTH WORKERS' PERCEPTIONS ABOUT INTRAVENOUS CANNULA-RELATED INFECTIONS AT TWO MAJOR CARIBBEAN HOSPITALS

* Onuoha, P.¹ | Best-Abhiram, H.¹ | Francis, C.¹ | Nelson-Castillo, M.¹ |
Kissoon-Ramesar, Y.¹ | Lalla-Mathura, B.¹

¹The UWI School of Nursing, Faculty of Medical Sciences, The University of the West Indies, St. Augustine, Trinidad and Tobago. * Corresponding Author.

ABSTRACT

Aim: To determine the perceptions of the health workers at two hospital in Trinidad with regard to their experiences with cannula use in the management of their patients.

Design: A cross-sectional descriptive survey was conducted using all categories of health who consented to participate in the study. Data was collected with researchers'-designed questionnaire structured to provide information on the health workers perceptions following their experiences with cannula-related infections in the management of their patients. Data was analyzed using the SPSS programme.

Result: Results show that majority of health workers perceptions varied. They also show some strong association between the health workers aspects of perceptions and some of their independent variables. Some discrepancies were identified.

Discussion: The discrepancies in the health workers' perceptions were discussed in line with literature.

KEYWORDS: Health workers, Caribbean, Cannula-related infections

Background:

It is common to see an IV catheters being used in hospitals despite the risk of associated complications. This can negatively affect the client's condition and add additional costs to the management of the clients. Thorough patient assessment and careful catheter management minimises the risk of complications (McCallum & Higgins, 2012, CDC 2002)

An average of 1 out of 3 hospital patients have peripheral venous catheters (PVC) insitu at any given time (Reilly et al., 2007). Catheters are small, hollow plastic like devices and are advanced over a needle into a peripheral vein via the skin. However, Infection and phlebitis are of primary concern (Royal College of Nursing, 2010), so registered nurses must ensure their knowledge and skills related to the management of PVCs are up to date and evidence based (Nursing and Midwifery Council, 2008) in order to reduce the complications associated with these devices (McCallum & Higgins, 2012, CDC, 2002).

Studies have shown the magnitude of the potential for PVCs to cause morbidity and mortality resulting from infectious complications. For example, intravenous catheters that were removed from their sites resulted from complications such as sepsis, thrombophlebitis or intrusion of fluids and had high rates of culture-positivity (Khanna, Mukhopadhyay, Vandana, Verma & Dabke, 2013). This can be the result of trying to deploy occluded blood manually, or infiltrated catheters delivered through an opening which presents toxins, and spreading of infections in short-term intravascular devices, including peripheral venous catheters, primarily from microorganisms inhabiting the IV catheter site (Kantor, 2010).

According to Agency of Healthcare Research and Quality (2009) "Intravenous Catheters are now the most common complication of hospitalized patients, with one out of every twenty patients in acute care settings acquiring one or more infections. There is an estimation of 1.7 million infections and 99,000 related deaths had occurred". The heavy expenditure concurred each year was between 28 billion to 33 billion dollars being spent to treat this phenomena in United States alone" (Agency of Healthcare Research and Quality, 2009).

Agency of Healthcare Research and Quality (2009) concluded that the four most important infections present in the hospital settings included pneumonia, catheter-related bloodstream infections (CRBSIs), invasive site infections, and infection related to urinary

catheters. Catheter-related bloodstream infections frequently occurred and was noted to be very fatal, as well as concurring a costly problem in the healthcare system (Agency of Healthcare Research and Quality, 2009).

Intravenous Catheters have been linked to catheter-related bloodstream infections with ever growing evidence that shows that this is a worldwide phenomenon and increases with each opportunity, and fatality each year (Moureau, 2009). Kokoris (2005) states "cost of the containment and infusion services application of best-practice strategies can reduce CRBSI significantly. Bacteria or fungi causes catheter-related infections and not necessarily the occurrence of sepsis

According to World Health Organisation Safety Curriculum - World Health Organization (2014), "the cost of caring and treating for infectious including catheter-related bloodstream infections has a significant negative impact on the health care budget. In the United States, it is estimated to be over \$45,000 million a year, the United Kingdom \$1000 pounds a year. In Thailand and Trinidad, the healthcare budget was 10 percent (World Health Organization, 2014).

The Centers for Disease Control and Prevention (CDC) predicts 850,000 catheter-associated infections (CAIs), and 50,000 categorized by CDC surveillance criteria as catheter-associated bacteremia (CABs), with case fatality, cases for CABs is 10,000 deaths (Shcmid, 2014). Shcmid (2014, and Kantor, 2010), further explain that in all cases, complications and fatality can be prevented by the health care team by following ethical practices.

Use of Antiseptic solution such as chlorhexidine except for infants under two months of age instead tincture of iodine, iodophor, and 70% alcohol are also acceptable for use (O'Grady, 2011; Center for Disease Control and Prevention (CDC), 2011, & Franklin et al, 2012).

Zingg and Pittet (2009) states "seriously ill and immune compromised clients are more susceptible to infection. CDC (2011) guidelines states that removal should be considered if the peripheral venous catheter (PVC) has been in situ for more than 72 hours due to increase complication with time (Hadaway, 2012).

The World Health Organization, WHO (2009), states that hand washing has been the most important step in breaking the chain of infection (Hadaway, 2012). The use of PVC, along with hand hygiene before

catheter insertion or maintenance, along with aseptic technique during catheter insertion, reduces infection (O'Grady et al., 2011). Proper hand hygiene may utilize either an alcohol-based product or an antibacterial soap with adequate rinsing (O'Grady et al., 2011).

However, according to O'Grady (2011) for Peripheral Venous Catheter manipulation, appropriate aseptic technique entails, disposable non-sterile gloves that may be used in conjunction with a "no-touch" technique for the insertion of peripheral venous catheters. Usage of gloves is recommended as standard precautions for the prevention of blood borne pathogen exposure (O'Grady, 2011). Central Venous Catheters (CVC's) carry a significantly greater risk of infection as indicated before, and the level of barrier precautions needed to prevent infection during insertion of CVCs should include full barrier precautions (cap, mask, sterile gown, sterile gloves, and large sterile drape) during the insertion (O'Grady, 2011).

The issue of the inserter's level of skill is critical when IV accesses are inserted. Two studies assessed the skills of inserters in relation to peripheral catheter outcomes. (Hadaway, 2012).

According to the CDC Guidelines (2011) the prevention of CR-BSI recommends removal of PVC after 96 hours, when it is clinically required to do so. These characteristics are based on the patient's condition, access site, skin and vein integrity, length and type of therapy, venue of care, integrity and patency of catheter, and the dressing and stabilization device being used (Moureau, 2009).

The CDC also stated "if the patient develops a signs of phlebitis such as tenderness, warmth, swelling of a palpable venous cord at the site of peripheral venous catheters, would be an indication to be removed immediately" (O'Grady, 2011; Deelchand, Cooke, Holmes & Vincent, 2012)

A study written in the British Medical Journal (BMJ) which was conducted in a hospital in Australia shows that intravenous catheter can be safely left in place for more than 72 hours once there are no contraindication present. The results indicated that replacing PVC's when clinically indicated has no effect on the incidence of failure, based on a composite measure of phlebitis or infiltration (Lavery, 2010).

Clinical practice differences between countries vary greatly. The techniques, methods, advancement in technology and its use, the level of skill by the inserter, use of antiseptics and application when inserting the peripheral catheter all play a major role in the development of CR-BSI's. It is up to the health care professional whether physician, technician or nurse to follow the appropriate guidelines when inserting an intravenous access. This is the only way accountability and safety of the patient will be ensured (Moureau, 2009).

In Trinidad and Tobago one of the main product for securing IV canulas are supplied products from a specific Company. In reference to the presentation transcript by this company on July 18th, 2012, 'Understanding Policies and Procedures' Trinidad & Tobago trip 2012, a Technical service indicated that the company has been working to establish International standards and trusted source for IV care solutions with their products. However, the transcript indicated that Trinidad and Tobago had several adverse events related to patient IV sites. They observed that the use of Elastoplast which is an aggressive adhesive causes challenges for medical practitioners in the local hospitals (Carlson et al, 2011).

In order to minimize the risk of infection as it relates to the use of intravascular therapy, the price should be paid to ensure patient safety. Technology changes, so methods of preventing infections will modify. Healthcare workers should be abreast of these changes which occur (O'Grady, 2011). Some suggestions to avoid CRBSIs were made according to Nursing Times (2010) which included the use of new technology such as ultrasound and infrared devices to visualize veins. The infrared specifically allows for non-touch technique which is an asset in reducing the risk of CRBSI (Hardaway, 2012)

Facilitating research, promoting awareness and knowledge, and sensitizing healthcare workers on the effects of IV cannula related infection as it relates to the individual's perception, may enhance the public's view of the healthcare system (Butt and Rich, 2008).

We envisaged that study will provide the necessary data for greater understanding of the subject matter in Trinidad and Tobago and may

assist with policies initiatives aimed at ensuring better patient management.

Objectives:

- Determine the perceptions of the health workers with regard to Intravenous related cannula infection in the selected hospitals.
- To ascertain if the health workers perceptions of the Intravenous cannula related infections within the hospitals are associated with their demographics

Research Questions:

- What are the Perceptions of Health care workers as it relates to intravenous related cannula infections?
- Are the Healthcare workers perception of intravenous related infections associated to their demographics?

Methodology

Research Design: A qualitative cross-sectional descriptive survey was conducted using three categories of health workers in two major hospitals in Trinidad who consented to give their perceptions with regard to their experiences during care of their patients with catheters with intravenous catheters. Sandelowshi (2000) opined that this is the method of choice when straight descriptions of phenomena are desired.

The target population and Sample Size: The target population for this research paper were healthcare workers who were in direct contact and were involved with patient care. The health care workers were all employed at the Eric Williams Medical Sciences Complex (EWMSC) and the Mount Hope Women's Hospital. They included Physicians, Registered nurses (RNs) and Enrolled Nursing Assistants (ENAs) and were estimated at about 840. However a total of three hundred (300) participants were targeted.

Instrument of Data Collection: The instrument was a questionnaire which was researchers-designed. The copies of the questionnaires were hand delivered to participants randomly and collected, over a period of one month by the investigators. The questionnaire consisted of two sections; the demographics in section A, while section B comprised of the items eliciting information on the health workers' perceptions related to cannula-relate infections based on their experiences. The content of this instrument was informed by literature while the structure, mostly on the perceptions was Likert-like type. As a result, the responses ranged from strongly disagree (1 point) to strongly agree (5 points) on a 5-point continuous scale

Data Analysis: The instrument structure allowed for frequency data in section A to be descriptively and summarily collated while attempt was made to analyse the data from section B as though they were continuous data. As a result more robust statistical analysis such as ANOVA were done to determine the relationships amongst the variables using the SPSS programme.

Ethical Considerations: All participants in the study were informed that participating in the research was voluntary and informed consent was obtained. Confidentiality and privacy of information from health care professionals were maintained at all times. Also, the institutional ethics approval was sought and received from the University of the West Indies, St. Augustine, Trinidad, as well as the necessary permissions from the hospital administration. Finally, the individual health workers were asked to sign the informed consents to signify their voluntary accent to participate in the study.

Result

Demographics:

The demographic characteristics of the health workers are represented in Table 1. The table illustrates that majority (46.9%) of the health workers within the age 28-37 years, and they are mostly females (87.7%) of African descent (36.9%) and had Diploma or Associate degree (65.7%). Majority (36.2%) have had between 5-7 years of experience on their jobs while 58.5% of them were registered nurses (Table 1).

As shown in Table 2, it represents the perceptions of health care workers in relation to IV cannula that participated in the survey, N=260. From the total number of participants, pertaining to the statement 'intravenous cannula contributed to infections', the data identi-

fied that 39.6% Strongly Agreed with this statement that indicated intravenous cannulas contributed to infections, 31.2 % Agreed, 16.5% were unsure, 6.5% Disagreed, and 6.2% strongly disagreed.

The data collected shows that 20.8% of the population Strongly Agreed that Healthcare workers are adequately trained with the techniques required when inserting IV catheters while, 25% just Agreed, 9.6% were Unsure, 19.6% Disagreed and the remaining 25% Strongly Disagreed.

Data shows that 13.5% of the sample population Strongly Agreed that doctors alone should insert the IV access , 11.2% Agreed, 8.1% were Unsure , 23.1% did Disagree and 44.2% Strongly Disagreed to this question.

Collected data displayed 56.9% of the population used in this research Strongly Agreed that trained nurses can help reduce the causes of IV related infections by educating the patient , while 20% Agreed to the same, 17.7% were Unsure , 1.2% Disagreed and the remaining 4.2% Strongly Disagreed with this belief.

Data gathered illustrates that 6.5% of the sample Strongly Agrees that the type of tapes used when securing an IV catheter may increase the risk of acquiring an infection, 13.8% Agree to this statement, 14.2% were Unsure , 35.4% Disagreed and 6.5% Strongly Disagreed . The remaining 23.6% of the population did not answer this question at all.

The table displays 43.5% of the sample population Strongly Agreed that central lines do predispose patients to infections, while 28.8% Agreed , 17% were Unsure of the issue, 6.9% Disagreed and 3.5% Strongly Disagreed.

It is displayed below that 20% of healthcare workers believe that antibiotic medications increases a patient's chances of acquiring an IV related infection , 25.8% Agreed to this also, 20.4% were Unsure, 23.5% Disagreed and 10.4% Strongly Disagreed to this statement.

The table shows that 34.2% of Healthcare workers Strongly agreed to the perception that septic patients are more susceptible to IV related infections, 38.1% Agreed , 15% stated that they were Unsure, 10% Disagreed and the remaining 2.7% Strongly Disagreed.

Data shows that 46.9% of Healthcare workers perceive that increased fluid overload causes tissue swelling and peripheral damage, while 30% Agree to this same matter, 15% were Unsure of the statement , 5% Disagreed and 3.1% Strongly Disagreed.

The table illustrates that 35.4% of the sample Strongly Agreed that inserting the wrong size of cannula on a patient increases the occurrence of IV infections, 34.2% Agreed to same, 10.4% remained Unsure, 13.8% Disagreed and 6.2% Strongly Disagreed .

Data displays 57.7% of the population Strongly Agreeing to the perception that through proper evaluation and observation of IV sites, IV infections will be reduced. Meanwhile, 23.8% agreed, 13.5% were Unsure, 2.7% disagreed and the remaining 2.3% strongly disagreed.

From the data, 34.6 % of healthcare workers Strongly Agree that IV catheters should be changed within seventy two hours after insertion, 31.9% Agreed to same, 16.5% were Unsure of the matter, 13.8% Disagreed and 3.1% Strongly Disagreed with the statement.

The data gathered illustrates 53.5% of the sample Strongly Agreeing to the use of aseptic techniques being used while inserting an IV catheter, while 26% Agreed, 15.4% were Unsure, 3.1% Disagreed and the remaining 1.5% Strongly Disagreed.

The table displays 39.2% of the sample population Strongly Agreeing that IV catheters should be removed if pain is experienced by the patient whether signs of infection are noted or not, 35.8% Agree to same, 8.8% were Unsure of their belief in this matter, 14.2% Disagreed and 1.9% Strongly Disagreed.

The data collected shows that 28.8% of Healthcare workers who participated in this research Strongly Agree that IV antibiotics can help reduce IV related infections. Meanwhile, 38.5% did also Agree, 10.4% remained Unsure, 15% Disagree and 7.2% strongly Disagreed.

The table illustrates data of 14.6% of the sample population's perception as they believed that patients did not seem bothered by IV related infections, 12.7% Agreed with this statement also, 5.8% remained Unsure of the matter, 34.6% Disagreed and 32.3% Strongly Agreed.

The sample population who believed that the re-occurrence of IV related infections is rare was illustrated in the table above as 5.8% Strongly Agreeing to this statement, 21.5% Agreeing , 16.5% being Unsure, 36.5% Disagreeing and the remaining 17.3% Strongly Disagreeing to this issue.

Table 4, also illustrated that 50.8% of the sample population who believe that through formulation of better policies and practices IV infection can be reduced. Meanwhile, 30% Agree to same, 12.3% still remained Unsure, 4.6% Disagreed and 2.3% Strongly Disagreed with the issue.

Through educating the public about the potential side effects of IV cannula related infection 47.7% of the population used in this research Strongly Agreed that it can assist in reducing infections, 35% also Agreed to such, 10% were Unsure of the matter in question, 6.2% Disagreed and the remaining 1.2% strongly Disagreed .

The table above illustrates that 44.6% of the sample population believed that reporting the incidence of IV related infections immediately should be done so appropriate measures and actions can take place, while 38.5% also Agreed, 10.4% were Unsure of the matter, 4.2% did Disagree and 2.3% Strongly Disagreed.

From the data collected, 15.8% of the population Strongly Agreed and believed that age and sex were underlying factors in acquiring IV related infections, while 26.5% Agreed, 18.5% remained Unsure, 25% Disagreed and 13.8% Strongly Disagreed.

From the data gathered, it is shown that 47.3% of the sample population Strongly Agree that through proper practices and techniques when inserting an IV catheter that infections will not occur, while 29.6% Agree with this statement, 16.2% remained Unsure of the matter, 4.6% Disagree and 2.3% Strongly Disagree.

Relationship between health workers perceptions and the selected demographic variables:

Tables 3 shows that there are significant relationship between the health workers (a) profession (Physician, Registered nurse and Enrolled Assistant) and the days it took to change the catheters, $p=0.017$, (b) level of education and their perception that IV cannula contributes to infection, $p=0.023$; (c) age and their perception that Type of tape used to secure contribute to infection $p= 0.000$; and experience and their perception that type of Tape used increases the risk of infection. It however shows that there is no significant relationship between the health workers experience and their perception of frequency to inspect the cannula sites.

Table 3: Relationship between workers Dependent variables and selected perceptions on Cannula-related infections.

(* $P > 0.05$; ** $p > 0.001$)

Selected Variables	(χ^2)	df	Sig	N (%)
Workers 'experience and Inspection of site	25.199	16	.066	10(40)
Profession and Change of Catheter every 72 hours	18.658	8	.017*	2(13.3)
Workers' education and belief that Catheter contribute to infection	44.788	28	.023*	27(67.5)
Health Workers' age vs Type of tape and increase in risk of infection	37.248	12	.000**	5(25.0)
Workers' Experience and Types of tape used increases risk of infection	30.082	16	.018*	8(32)

Table 1: Demographics of the Health Care Workers. N=260

	Demographics	Frequency (f)	Percent(%)
Age	18-27	55	21.2
	28-37	122	46.9
	38-47	57	21.9
	>47	26	10.0
Sex	Male	32	12.3
	female	228	87.7
Ethnicity	East Indian	75	29.2
	African	95	36.9
	Mixed	83	31.9
	Other	7	1.9
Education	Primary & Secondary	6	2.3
	Diploma & Associate Degree	171	65.7
	MBBS	26	10
	BSc & MSc	57	23.5
Experience in years	Under 5 years	74	28.5
	5-9 years	94	36.2
	10-14	45	17.3
	15-24	23	8.8
	25 or more	24	9.2
Profession	Physician	40	15.4
	Registered nurse	152	58.5
	Enrolled nursing assistant	68	26.2

Perceptions on intravenous cannula-related infections:
Table 2: Showing the Perceptions of healthcare workers with regard to Intravenous cannula-related infection in percentages. N=260 (SA=strongly agree, A=Agree, U=Unsure, D=Disagree, SD = Strongly Disagree)

	SA	A	U	D	SD
Intravenous catheters contribute to infections	39.6	31.2	16.5	6.5	6.2
Health care workers are trained adequately in IV catheter insertion techniques	20.8	25	9.6	19.6	25
Doctors should only be allowed to insert IV catheters	13.5	11.2	8.1	23.1	44.2
Nurses who are trained in IV catheter insertion can help reduce the causes of IV related infections by teaching clients to identify early signs and symptoms	56.9	20.0	17.7	1.2	4.2
The type of adhesive tape used to secure IV catheters increases the potential risk of the patient acquiring an IV related infection	6.5	13.8	14.2	35.4	6.5
Central line catheters predispose patients to higher risk of infections	43.5	28.8	17.	6.9	3.5
Medications such as Vancomycin and Augmentin(antibiotics) increase a patient's risk of acquiring an infection	20	25.8	20.4	23.5	10.4
Patients who are already immunocompromised are more prone to IV cannula infections	34.2	38.1	15.0	10.0	2.7
Increase fluid overload cause tissue swelling and peripheral damage	46.9	30.0	15	5.0	3.1
Placing the wrong size IV cannula increases the occurrence of infection	35.4	34.2	10.4	13.8	6.2
The proper evaluation and observation of an IV cannula on a patient can lead to a decrease in infections occurring	57.7	23.8	13.5	2.7	2.3
IV catheters must be changed within 72 hours of insertion	34.6	31.9	16.5	13.8	3.1
Ascetic techniques should always be used when inserting an IV cannula	53.5	26.	15.4	3.1	1.5
If a patient complains of pain, the IV catheter should be removed , even if there are no signs of an infection	39.2	35.8	8.8	14.2	1.9
Antibiotic treatment helps reduce IV related infections	28.8	38.5	10.4	15.0	7.2
Patients do not seem to be bothered by an IV related infections	14.6	12.7	5.8	34.6	32.3
The re-occurrence of an IV related infection is rare	5.8	21.5	16.5	36.5	17.3
Through formulation of better policies and practices, IV infections can be reduced	50.8	30.0	12.3	4.6	2.3
Educating the public on the possible side effects of IV cannulation can assist in reducing these types of infections	47.7	35.0	10.0	6.2	1.2
Persons should report IV infections immediately to the relevant authorities so that actions may be taken to ensure this does not occur in the future	44.6	38.5	10.4	4.2	2.3
Age and sex may be a factor in acquiring an IV related infection	15.8	26.5	18.5	25.0	13.8
Practicing proper techniques when inserting an IV catheter ensures infections do not occur	47.3	29.6	16.2	4.6	2.3

Discussion:

The purpose of the study conducted was to show the perceptions of the health care workers on Intravenous cannula and its connection to infections. A total N=260 participated in the survey. Innately, N=300 questionnaires was distributed. The survey was conducted in both Mt hope Women's Hospital and Eric Williams Medical Science Hospital. The results clearly showed that in general the health workers' perceptions of cannula related inspections varied irrespective of their profession, level of education or age as noted by O'Brian (2007).

Of note is that although nearly 70% indicated that they observed the aseptic technique while introducing catheters, as many as 30.4% indicated that they do not use aseptic techniques. This percentage is far too high given warnings of Moureau (2009), McCallum and Higgins, (2012) and Franklin et al, (2012).

There is a likelihood of spreading infections to the patient in the cases of bare hands only and no hand washing as according to Moureau (2009), workers own skin flora can spread infection. This was stated by the Health Protection Scotland (2012), that infection can take place at the insertion site as a microorganism consequence of the presences of these organisms on the patient's own flora or the cross-contamination due to the health workers unacceptable hygiene practices (McCallum & Higgins, 2012).

It could be seen that there are some discrepancies in the results. For example, 176 (69%) of the health workers indicated that they observed aseptic technique being used, but only 149(56%) of them indicated that they practised both hand washing and use gloves when cannulation, which is the proper technique. The differences in perception are noted by 13% of the health workers. It begs the question then, what is the health workers correct perception of the proper techniques being used? We note is the perceptions of the health workers with regard to the type of adhesives used to secure the IV catheters. Table 2 illustrates that only 20.3% of the respondents indicated that the type of adhesive used to secure the catheters can potentially contribute to the risk of infection while more than double that percentage disagreed or strongly disagreed that the type of adhesive can contribute to risk of infection. These observations and perceptions of the health workers are outside the international recommendations for the stipulated materials for use in IV catheters (O'Grady et. al. (2011); Carlson et al, (2011) and Cart, et al, (2014).

Acknowledgement:

The research team will like to express their appreciation to the participants from the two hospitals as well as the managements of the two hospitals for their consent and permission respectively to undertake the study.

REFERENCES:

1. American Nursing Association, 2014. What is nursing? Retrieved from <http://www.nursingworld.org/EspeciallyForYou/What-is-Nursing>
2. Agency of Healthcare Research and Quality. (2009). AHRQ's Efforts to Prevent and Reduce Health Care-Associated Infections Retrieved from <http://www.ahrq.gov/research/findings/factsheets/errors-safety/haiflyer/index.html>.
3. ArticleID=867417#P13.
4. Berding, J.W.A (2012). Education and Experiences. Retrieved from <http://ruby.fgcu.edu/courses/ndemers/colloquium/experienceducationdewey.pdf>
5. Bureau of Labour Statistics (2014) . What Physicians and Surgeons Do? Retrieved from <http://www.bls.gov/ooh/healthcare/physicians-and-surgeons.htm>
6. Butts, J.B. & Rich, K. (2008). Nursing ethics: Across the curriculum and into practice, (2nd ed.). Jones and Bartlett Publishers.
7. Carlson, A., Loegering, C.L., Zehrer, C., Walters, S. (2011). Skin & Wound Care Impact on Cost: Adhesive Foam Wound Dressing Comparisons in Home Care, Long-Term Care, and Hospital Settings. Retrieved from <http://go.3m.com/c3sd.slideshare>.
8. Carty, N, Wibaux, A, Ward, C, Paulson, D & Johnson, P (2014). Antimicrobial activity of a adhesive containing chlorhexidine gluconate (CHG) against the resident micro flora in human volunteers. Retrieved from <http://jac.oxfordjournals.org/content/early/2014/04/09/jac.dku096.full>
9. Centres for Disease Control and Prevention. (2002). Guidelines for the Prevention of Intravascular Catheter-Related Infections. Morbidity and Mortality Weekly Report. Retrieved from <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5110a1.htm>

10. Centre for Disease Control and Prevention. (2011). Guidelines for the Prevention of Intravascular Catheter-Related Infections. Retrieved from <http://www.cdc.gov/hicpac/bsi/04-bsi-background-info-2011.html>
11. Center for Disease Control and prevention. (2014). State immunization laws for health care workers and patients. Retrieved from <http://www2a.cdc.gov/vaccines/statevaccsApp/default.asp>
12. Cherry, K. (2015). Perception and the Perceptual process. Retrieved from <http://psychology.about.com/od/sensationandperception/ss/perceptproc.htm>
13. Collins English Dictionary. (2015). Health care worker <http://www.collinsdictionary.com/dictionary/english/health-care-worker>
14. Ellis, J.R., & Hartley, C., L. (2009), Managing and Coordinating Nursing Care, 5th Ed., Lippincott Williams & Wilkins, 530 Walnut St., Philadelphia, PA.
15. Franklin, B .D., Deelchand, V., Cooke, M., Holmes, A., & Vincent, C. (2012). The safe insertion of peripheral intravenous catheters: A mixed methods descriptive study of the availability of the equipment needed. The safe insertion of peripheral intravenous. Retrieved from <http://www.arjournal.co/content/11/1/5>.
16. Hadaway, H. (2012). Short Peripheral Intravenous Catheters and Infections. Journal of Infusion, vol 35(4). Pages 230-240. Lippincott Nursing Centre.com. Wolters Kluwer. Retrieved from <http://www.nursingcenter.com/Inc/static?pageid=1374281>
17. Hannan, A., & Anderson, J. (2007). Questionnaires in Education Research, Faculty of Education, University of Plymouth. Retrieved from: http://www.edu.plymouth.ac.uk/resined/QUESTS/index.htm#C.____QUESTIONNAIRE_DESIGN_-_an_example
18. <http://guides.mclibrary.duke.edu/content.php?pid=431451&sid=3529499>
19. Hegner, B, Acello, B, Caldwell, E- Nursing Assistant: A Nursing Process Approach- Basics. Delmar 5 Maxwell Drive Park, NY 12065-2919 USA.
20. Kantor, G.S. (2010). Intravenous Catheter Complications-Net wellness Consumer Information. Retrieved from <http://www.netwellness.org/healthtopics/ivcomplications.cfm>.
21. Khanna, V., Mukhopadhyay, C., Vandana, K. E., Verma, M. and Dabke, P. (2013). Evaluation of Central Venous Catheter Associated Blood Stream Infection: A Microbiological Observational Study. Evaluation of Central Venous Catheter Associated Blood. Journal of Pathogens Volume 2013, Article ID 936864, Retrieved from <http://dx.doi>.
22. Lavery, I. (2010). Infection control in IV therapy: a review of the chain of infection. British Journal of Nursing, Vol 19(9). Pub Med.gov. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/21042241>
23. Maki, D.G., Weise, C.E., & Sarafin, H.W. (1977). The New England Journal of Medicine. A semi quantitative culture method for identifying intravenous catheter related infection, 296 (3) Retrieved from <http://www.nejm.org/doi/pdf/10.1056/NEJM197706092962301>
24. Mander, B. (1997). The intravenous cannula: more than just drug administration. Infection Control, vol 2(issue 4). Retrieved from http://www.publish.csiro.au/?act=view_file&file_id=HI97417.pdf
25. Mc Ewen, M. & Wills, E. (2011). Theoretical Basis for nursing (3rd Ed.), Lippincott Williams & Wilkins
26. McCallum, L., & Higgins, D. (2012). Care of peripheral venous cannula sites. Nursing Times. Vol 8(3). Retrieved from <http://www.nursingtimes.net/>
27. Moureau, N .L (2009). I.V. ROUNDS: Reducing the cost of catheter-related bloodstream infections. Nursing 2014.vol.39 (7).Pages 14- 15. Lippincott Nursing Centre.com. Wolters Kluwer. Retrieved from <http://www.nursingcenter.com/Inc/journalarticle?>
28. Nicholson, A.M., Legister, S., Gayle, P., Williams, T., Lindo, T., Castle, D., Shaw, K., Moonah, S. (2009) et al. Distribution of nosocomial organisms and their resistance patterns in the Intensive Care Unit of the University Hospital of the West Indies,
29. O'Brian, D. (2007). Perception Objects- Internet Encyclopaedia Phycology. Retrieved from <http://www.iep.utm.edu/perc-obj/>
30. O'Grady, N.P, Alexander, M, Burns, L.A. et al. (2011). Guidelines for the Prevention of Intravascular Catheter-Related Infections. Retrieved from <http://www.cdc.gov/hicpac/pdf/guideline/bsi-guidelines-2011.pdf>. a. org/10.11/2013/936864
31. Sandelowski, M. (2000). Focus on Research Methods- Whatever happened to Qualitative Description?. Research in Nursing & Health, 23, p. 334-340. University of North Carolina at Chapel Hill, #7640, Carrington Hall, School of Nursing, Chapel Hill, NC 27599, Retrieved from: <http://www.wou.edu/~mcgladm/Quantitative%20Methods/optional%20stuffs/qualitative%20description.pdf>
32. Schmid, M.W. (2014). Preventing Intravenous Catheter-Associated Infections. Retrieved from www.infectioncontroltoday.com.
33. Shlamovitz, G.Z & Rowe, V. L. (2013). Intravenous Cannulation - Medscape Reference. Retrieved from

<http://www.emedicine.medscape.com/article/1998177-overview>.

34. Spelman, D.W. (2002). Hospital- acquired infections .The Medical Journal of Australia. MJA Practice Essentials: Infectious Diseases. 176 (6).Retrieved from <https://www.mja.com.au/journal/2002/176/6/2-hospital-acquired-infections>
35. Who Safety Curriculum - World Health Organization.Retrieved from www.who.int/patientsafety/education/curriculum/who_mc_topic-9.pdf
36. Woods, P., & Pratt, N. (2006). Qualitative Research, Faculty of Education. University of Plymouth. Retrieved from: <http://www.edu.plymouth.ac.uk/resined/Qualitative%20methods%202/qu alrshm.htm#Sampling>
37. World Health Organization, (2002). Prevention of hospital-acquired infections: A PRACTICAL GUIDE. Retrieved from <http://www.who.int/csr/resources/publications/drugresist/en/whodscsrep h200212.pdf?ua=1>